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SUGAR AND ALCOHOL FROM WOOD

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Sugar from Wood

USSR timber resources, which make up one third of the world's total forest acreage, are important sources of raw material for the chemical industry. Cellulose, obtained from wood, is utilized in the manufacture of paper, artificial silk, cellophane, and explosives. When wood is subjected to a saccharification process it is possible to obtain alcohol, glycerine, glucose, lactic acid, acetic acid, and other organic compounds.

The present Five-Year Plan calls for yearly preparation of a quarter billion cubic meters of timber. However, only about 30 to 35 percent of a tree is utilized while the remaining 65 to 70 percent is considered waste. Formerly, this waste was used exclusively for fuel purposes. Recently, however, much of the waste has been converted into edible substances or into raw material for the chemical industry. Thus it has been shown that one ton of wood tailings produced as much alcohol as one ton of potatoes or 300 kilograms of grain. It has been determined that a small mill, equipped with only two saws, will be able to produce enough tailings for a yearly production of one million liters of alcohol. Hay, wild plant life, undergrowth, marine plant life have all been considered good food and technological raw materials sources. Research has determined that one ton of hay will produce as much as 150 liters of alcohol.

Alcohol from Tailings

In 1931 Professor V. I. Sharkov of the Leningrad Wood Technical Institute started to saccharify tailings. By 1933, there was regular production of wood alcohol at the Chernovets Experimental Station. In 1935 the first large hydrolysis plant was built. The raw materials used at this plant included tailings from lumber enterprises and waste from cellulose paper factories.

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At the cellulose and paper factories about 4 percent of the wood pulp was discarded after processing. This was considered waste. Furthermore, it had a high sulfur content and had to be purified before being deposited in rivers. Experiments showed that if this 4 percent waste was treated properly, some 60 to 70 percent of the sugar it contained could be converted into alcohol. The residue after this process still contained enough sugar to warrant its use as feed for cattle. The liquid resulting from the process was treated to manufacture a bonding material used in foundry work. It was determined that one ton of this bonding material could replace 0.5 ton of dextrin, or 0.33 ton of drying oil, or 1.45 tons of molasses.

The cost of manufacturing wood alcohol is very low. It is further lowered by using the by-products as cattle feed. Today after the saccharification process, wood chips produce up to 90 percent by weight of glucose. This is in the form of molasses which can then be further refined into alcohol or cattle feed.

Each year Soviet agriculture wasted many million tons of grass, etc. Soviet science came to the rescue, and now much of this former waste is utilized. For example, N. A. Sychev and N. M. Chetverikov developed a method for obtaining molasses from hay and wheat chaff. Academician Poray-Koshits developed a method for converting sunflower seed shells into a substance known as furfurol, used in the manufacture of plastics, as well as in anti-acid coatings.

Professor Pervozvanskiy and Professor Kurbatov developed a method for obtaining alcohol from low grade peat. This is a valuable discovery since alcohol is utilized in some 5,000 ways.

Hydrolysis

Hydrolysis has been adopted for breaking down complex sugar compounds into simple ones. This is accomplished by hydrolyzing a sugar solution formed by adding water to a complex sugar. Large hydrolysis plants have been built to saccharify wood and plant products. Saccharification cannot take place in cold water. Consequently, an acid or acid salt catalyst has to be added.

In this saccharification process, the wood tailings are reduced to chips. They are then subjected to an acid bath at temperatures around 200 degrees. This process converts more than half of the wood into an impure sugar solution. Filtering takes out the lignin in the solution and prepares it for final processing. The sugar solution is then alkalized by adding lime water to neutralize the high acid content. The mixture is heated at 60 to 80 degrees for a period of 4 to 5 hours, filtered, and the filtrate cooled to 25 degrees. Yeast is added and after 24 to 36 hours "crude" alcohol is produced. This is then refined, and the resulting alcohol is ready for distribution.

Ferments in the Air

Yeast and mold are some of the most beneficial forms of fungus which float free in the air. There are also the zymotes which change liquids into wine, beer, etc. Bread contains about 6 to 7 percent albumin, meat 20 to 25 percent, and fungus as much as 45 percent. Cultivation of fungus produces albuminous yeast. Other valuable molds are those belonging to the penicillin family.

The controlled action of yeasts and other microorganisms changes wood into alcohol and several other by-products. From one ton of dry shavings it is possible to manufacture 650 kilograms of edible sugar, 300 kilograms of lignin, and 40 kilograms of acetic acid. However,

depending on the fermentation and processing method, this same ton of shavings will produce 370 liters of pure alcohol, 100 kilograms of glycerine, and 500 kilograms of edible yeast.

If, during the saccharification process, the wood is acted on by sulfuric acid, the resulting product is not alcohol but glycerine. Glycerine output is usually about 25 percent of the original sugar content.

Yeast is a valuable nutritional substance. One kilogram of dry yeast contains as much albumin as 5 kilograms of meat. At present, it is possible to produce 200 to 250 kilograms of dry yeast in a 50-cubic-meter vat every 24 hours. The nutrient solution for growing yeast needs to contain only 1 to 1.5 percent wood sugar, but this small amount is converted 83 percent into albumin. Each liter of yeast solution produces 15 to 17 grams of albumin which can be filtered out and then pressed into cakes. Thus with the aid of microorganisms it is possible to obtain materials which contain up to 50 percent easily assimilated albumin. Albuminous yeast is used to feed cattle and thus it is possible to obtain Vitamin D-containing milk even in winter. Some molds which are grown on aqueous solutions of wood sugar produce 30 to 50 percent fats from which edible and industrial fats are obtained.

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